Three New Combinations in *Pfaffia* (Amaranthaceae) from the New World Tropics

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ABSTRACT. The new combinations *Pfaffia aurata* (Martius) Borsch, *Pfaffia completa* (Uline & W. L. Bray) Borsch, and *Pfaffia costaricensis* (Standley) Borsch are made. In analyzing the pollen morphology and floral structures of the three species, it is shown that they belong to *Pfaffia* Martius and not to *Iresine* P. Browne, nom. cons.

Pfaffia belongs to Amaranthaceae subfamily Gomphrenoideae (Schinz, 1934; Townsend, 1993). It comprises about 35 species, all characterized by long trichomes arising in tufts from the pedicel or the base of the perianth, a bilobate stigma, and the flowers all being hermaphrodite. The genus is distributed in the New World, according to Stützer's (1935) monograph, ranging from Mexico southwards throughout the tropics, including the Amazon basin, to the region of Bahía Blanca, Argentina.

During preparation of the Amaranthaceae treatment for *Flora de Nicaragua* and subsequent studies in the genera *Pfaffia* and *Iresine*, three new combinations turned out to be necessary.

Pfaffia aurata (Martius) Borsch, comb. nov. Basionym: *Trommsdorffia aurata* Martius, Nova Genera et Species Plantarum, Vol. 2: 41. 1826. TYPE: Brazil. Provinciae Rio Negro: habitat in argillosis praeruptis oparatis flu[. . .] Japurá ripis ad Mar[ibis], Dec.–Jan., *C. F. P. v. Martius s.n.* (holotype, M).

Pfaffia completa (Uline & W. L. Bray) Borsch, comb. nov. Basionym: *Iresine completa* Uline & W. L. Bray, Bot. Gaz. (Crawfordsville) 21: 349. 1896. TYPE: Honduras. Santa Bárbara: San Pedro Sula, 200 m, *C. Thieme 338* (holotype, US; isotypes, BM, K). Figure 1.

Iresine wrightii Standley, Contr. U.S. Natl. Herb. 18: 97. 1916. Syn. nov. TYPE: Nicaragua [Herbarium of the U.S. North Pac. Expl. Exped. under Commanders Ringgold and Rodgers 1853–1856], *C. Wright s.n.* (holotype, US).

Iresine calea (Ibáñez) Standley, Contrib. U.S. Natl. Herb. 18: 94. 1916.

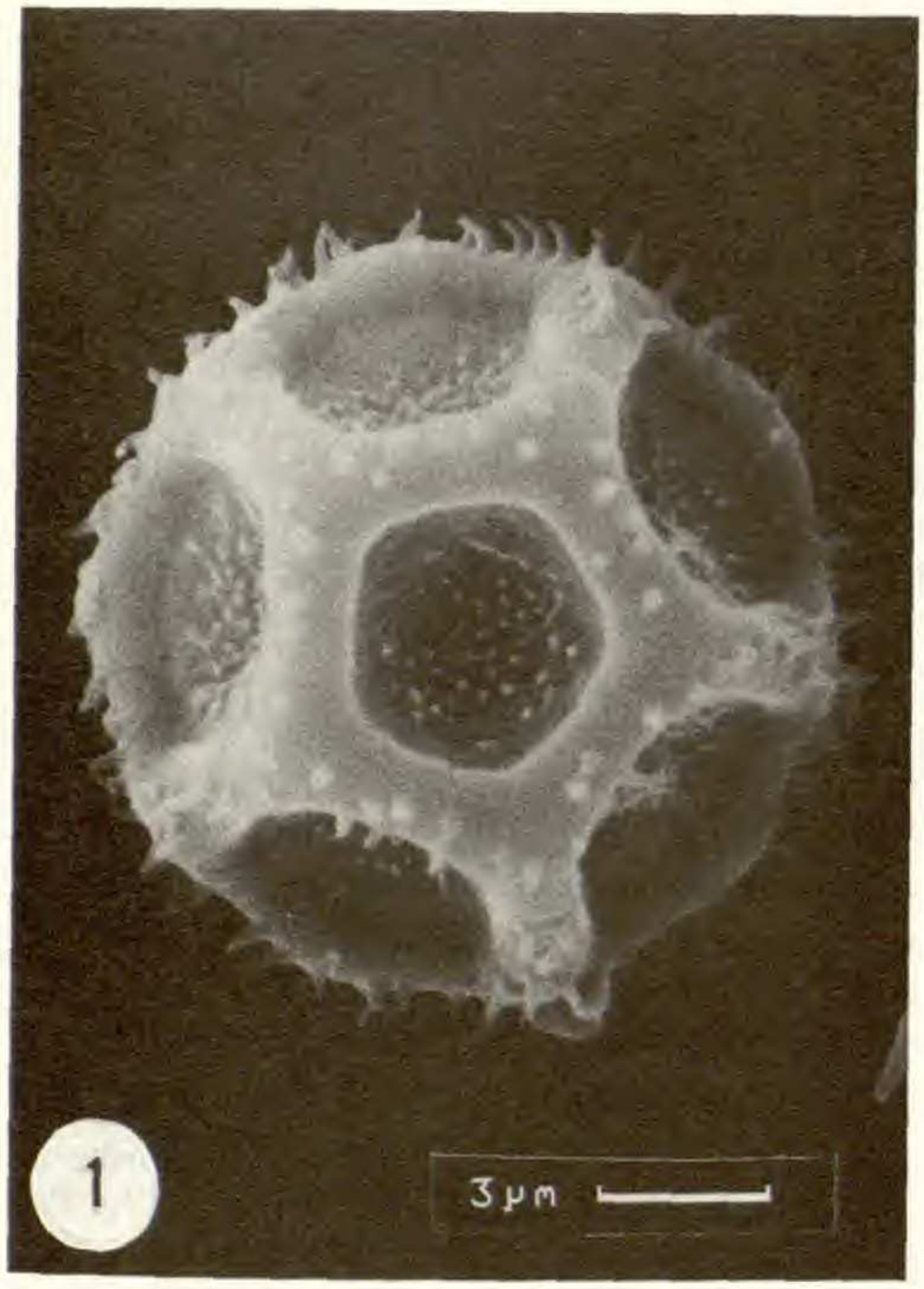
Iresine completa Uline & W. L. Bray f. *glabriuscula* Suessenguth, Repert. Spec. Nov. Regni Veg. 39: 11. 1935. Syn. nov. TYPE: Mexico. Mazatlán: Felsige Abhänge, Jan.–Mar. 1902, *C. A. Purpus 362* (holotype, WU).

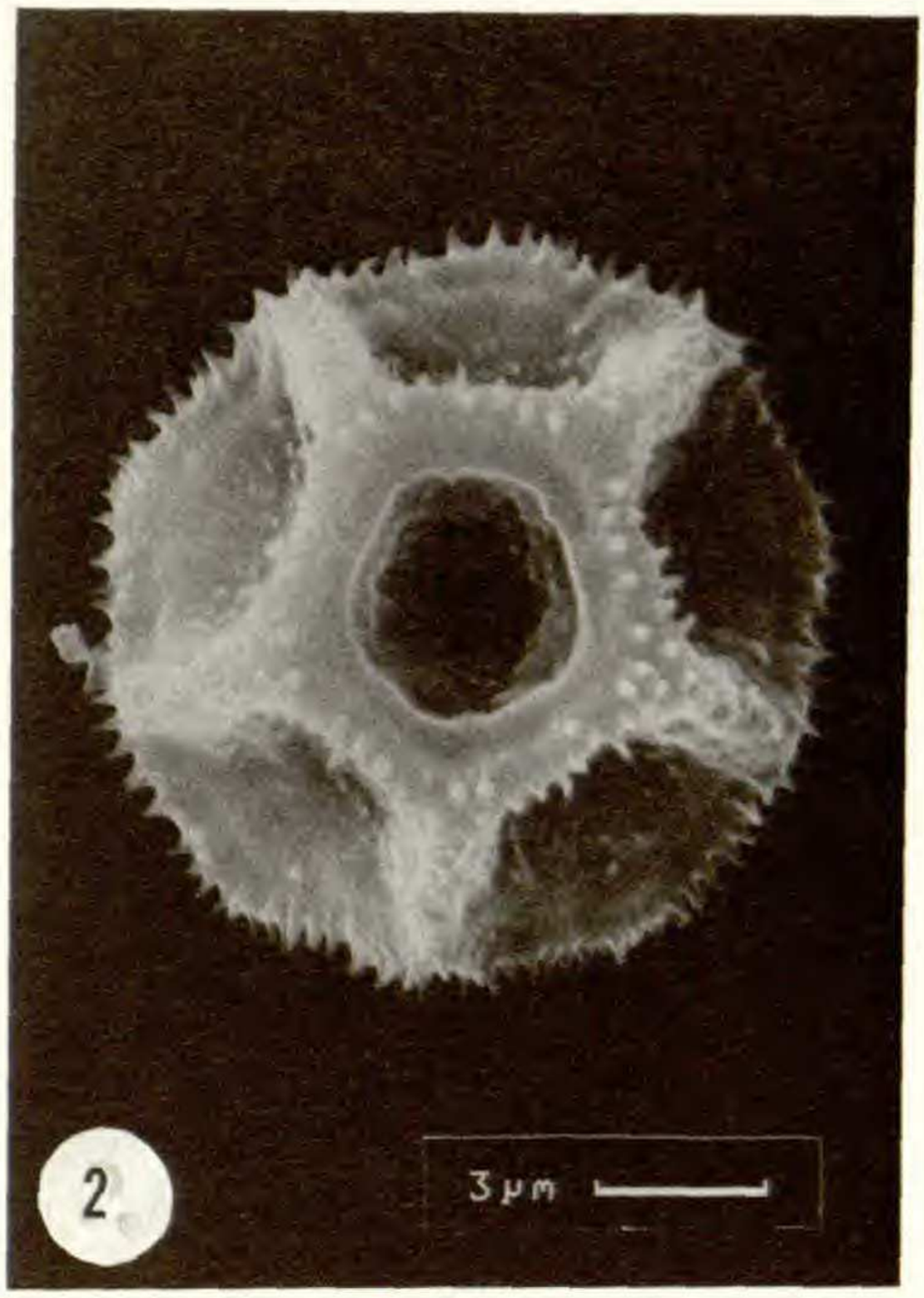
There has been some confusion about the identity of this species because John Donnell Smith renumbered Thieme's specimen (*Thieme 338*) with his own number, 5443. There is a second collection by Thieme from the same locality in Honduras, renumbered 5447. Suessenguth (1934) erroneously cited "*Donnell-Smith n. 5447*" as the type. This specimen (BM, US) is a functionally male plant of *Iresine calea* (Ibáñez) Standley. It has small pistillodes and might have been interpreted as being hermaphroditic for that reason, but the plant lacks the long basal trichomes that in hermaphroditic or functionally female flowers of all species of *Iresine* serve for wind dispersal. Obviously, this specimen cannot be the type mentioned by Uline & Bray (1896). In line with his misinterpretation, Suessenguth (1935) described *Iresine completa* Uline & W. L. Bray f. *glabriuscula* Suessenguth from a specimen that is a functionally male plant of *Iresine calea*.

When publishing *Iresine completa*, Uline & Bray (1896) stressed the complete hermaphroditism of their plant, a remarkable character in contrast to the many species belonging to *Iresine* which are dioecious or polygamous. It is obvious that they called it "*completa*" for that reason.

Pfaffia costaricensis (Standley) Borsch, comb. nov. Basionym: *Iresine costaricensis* Standley, Contrib. U.S. Natl. Herb. 18: 94. 1916. TYPE: Costa Rica. Tucurrique, Buissons à Las Vueltas, 635 m, Mar. 1899, *A. Tonduz 13183* (holotype, US; isotypes, K, US). Figure 2.

Pfaffia aurata, *P. completa*, and *P. costaricensis* show the bilobate stigma, which is a distinguishing character of *Pfaffia*. In *P. aurata* the lobes have almost the outline of an equilateral triangle. In *P. completa* the lobes are narrowly triangular, and in *P. costaricensis* the stigma is shaped more or less





Figures 1, 2. Scanning electron (SEM) photomicrograph of air-dried pollen. —1. *Pfaffia completa* (*Thieme 338*, BM). —2. *P. costaricensis* (*Tonduz 13183*, K).

like a mushroom cap and the lobes are very short and broad. All three species have subequal, 3-veined tepals with a tuft of long, straight and stiff simple trichomes arising abaxially at the base of the tepal and from the pedicel. The flowers are always hermaphroditic. Duke's (1961) suspicion that *P. completa* could be a polygamous species with the pistillate flowers perfect and the staminate flowers bearing pistillodes is a result of the above-mentioned confusion about the species' identity. In all three species the filaments are united at the base into a shallow cup. Broadly rounded pseudostaminodia are present, which are distinctly shorter than the free part of the filament. Sometimes they are notched at the apex or they are indistinct and the margin of the cup is only slightly raised.

The pollen grains of *Pfaffia aurata*, *P. completa* (Fig. 1), and *P. costaricensis* (Fig. 2) are pantoporate, having 12–14, 5-angular lumina and sunken pores. They represent the *Gomphrena*-type, one of two major pollen types in the Amaranthaceae (Erdtman, 1952). The *Gomphrena*-type is placed in a specialized category in Nowicke's (1975) study of centrospermous pollen. *Pfaffia* has pollen of the *Gomphrena*-type, whereas pollen of *Iresine* is similar to the *Amaranthus*-type of Erdtman, which corresponds to Pollen-Type II of Nowicke (1975). In *Pfaffia aurata*, *P. completa*, and *P. costaricensis*, the tectum appears to cover the columellae completely and the muri have more or less vertical sides. The extraporal sexine bears distinct elongate spinules in all three species. This is exactly the same structure as in species of *Pfaffia* (see illustrations of *Pfaffia* pollen by Nowicke & Skvarla (1979), Cuadrado (1988), Eliasson (1988), and Townsend (1993)). There is only variation in aperture number, which is known to occur between species within many genera of Amaranthaceae. Eliasson (1988) showed *Pfaffia*-pollen to have a row of warts or spinules on the distal part of their tectum. In *P. aurata*, a species illustrated by Eliasson as figure 34 under the misapplied name *Pfaffia paniculata* (Martius) Kuntze, these rows are not very straight. In investigating more specimens of *P. aurata* from different localities the same observation was made. Sometimes the spinules were in an undulate row, some of them even side by side. The pollen of *P. costaricensis* (Fig. 2) also has some of the spinules side by side, but there is a certain amount of variation, from a side by side arrangement of the spinules to straight rows, even within a number of grains from a single anther. In contrast to *Iresine*,

the spinules are never evenly spread over a more or less convex distal part of the tectum. In *Iresine* the pores are small and apertures cover a minor part of the surface of the grain. *Iresine angustifolia* Euphrasén has more specialized pollen with wider pores, compared to the other species of the genus, but the distal parts of the tectum are still convex and the spinules are evenly spread.

Pfaffia aurata, P. completa, and *P. costaricensis* are closely related and belong to a group that was described as *Trommsdorffia* by Martius (1826). In 1839 Dietrich transferred *Trommsdorffia aurata* Martius (the type species of *Trommsdorffia*), *T. argentata* Martius, and *T. pulverulenta* Martius to *Iresine* P. Browne. Similarities in habit (all species being scandent shrubs or lianas), several times branched racemose inflorescence structures, and the common occurrence of long trichomes serving for dispersal were the decisive factors for merging the two genera. My own studies in connection with a revision of *Iresine* revealed that *Trommsdorffia* is different from *Iresine* not only in pollen morphology but also in floral structure, most strikingly in the morphology of the stigma (two more or less elongated, filiform branches). *Iresine* and *Trommsdorffia* belong to completely different evolutionary lines. This is also supported by the strong trend to the evolution of polygamous or dioecious species in *Iresine,* whereas the relatives of *Pfaffia aurata* and all other species of *Pfaffia* are generally hermaphroditic. Consequently, *Trommsdorffia* has to be excluded from *Iresine. Trommsdorffia pulverulenta* Martius (= *Pfaffia densipellita* Borsch), a morphologically well defined species also allied to *P. aurata* from Peru, was excluded from *Iresine* earlier (Borsch, 1993).

Pfaffia aurata and its allies form a small group of closely related species within the genus *Pfaffia.* Differences from the other species of *Pfaffia* are merely a matter of degree. The occurrence of more or less broadly rounded pseudostaminodia in *P. aurata* and its relatives is not sufficient to support generic status. Their position within the genus *Pfaffia* and the generic concept of *Pfaffia* will be discussed in detail in a separate paper. It is questionable whether *Trommsdorffia argentata* Martius is specifically distinct from *Pfaffia aurata,* and several other morphologically very similar taxa (e.g., *Iresine argentata* (Martius) D. Dietrich var. *amazonica* Seubert = *Iresine aurata* (Martius) D. Dietrich var. *amazonica* (Seubert) Suessenguth) are being studied more thoroughly before a taxonomic decision is made as to their status among the relatives of *P. aurata.*

Pfaffia aurata has tepals that are ovate-oblong, 3-veined, 1.3–1.8 mm long and stigma lobes that have more or less the outline of an equilateral triangle. *Pfaffia completa* is characterized by its tepals, which are narrowly triangular, prominently 3-veined, about 2.5 mm long, narrowly triangular stigma lobes becoming almost cylindrical at top, and broadly lanceolate blades, which are glabrous on the upper and sparsely pubescent on the lower surface. *Pfaffia costaricensis* has extremely small floral parts and conspicuously finely branched inflorescences, representing 3–4 times branched racemose structures with strictly opposite branches. The tepals are ovate, 1.1–1.3 mm long, and indistinctly 3-veined. The stigma lobes are very broadly rounded, even shorter and broader than in *P. aurata.* The anthers have a length of 0.2 mm, in contrast to the other species, which have anthers that are about 0.4 mm long. Burger (1983) described the characteristic elliptic or broadly elliptic leaf blades of *P. costaricensis,* with up to 12 pairs of major secondary veins.

Pfaffia aurata probably ranges throughout the Neotropics. In Ecuador the species is well established in virgin forests as well as rastrojos, according to the *Flora of Ecuador* (Eliasson, 1987). There the species is erroneously called *Pfaffia paniculata* (Martius) Kuntze, a name of a different taxon belonging to a group of closely related species that were described as *Hebanthe* by Martius (1826). Suessenguth (1934) described *Pfaffia completa* as occurring from Guatemala to Costa Rica. This range is partly a consequence of the misinterpretation of the species's identity. In herbaria many older specimens identified as *Iresine completa* Uline & W. L. Bray belong in fact to *Iresine calea* (Ibáñez) Standley. Apart from the type locality in Honduras, *Pfaffia completa* is at the moment proven to occur in Nicaragua and Panama. Two specimens exist from Nicaragua. One has been collected recently on Isla de Ometepe in Lago de Nicaragua, and the other is the type of *Iresine wrightii.* The single specimen from Panama has been collected in the Darién and is also cited by Duke (1961). *Pfaffia costaricensis* is endemic to Costa Rica and is known only from the central part of the country (Burger, 1983). A recent collection has been made in a remote area in Puntarenas, where the plant was climbing on secondary woody vegetation (Hammel, pers. comm.).

Additional specimens examined. **Iresine calea** (Ibáñez) Standley (specimens incorrectly identified as *Iresine completa* Uline & W. L. Bray): COSTA RICA. **Puntarenas:** Santo Domingo de Golfo Dulce, *Tonduz 9861* (BM). HONDURAS. **Santa Bárbara:** San Pedro Sula, *Thieme s.n.,* renumbered by Donnell Smith *5447* (BM,US). NIC-

ARAGUA. **Managua:** S of Managua, *J. M. & M. T. Greenman 5725* (MO). ***Pfaffia aurata*** (Martius) Borsch: NICARAGUA. **Boaco:** San José de los Remates, *Moreno 20337* (MO). **Rivas:** Isla de Ometepe, al NE del Volcán Concepción, *Sandino 4233* (FR, HNMN not seen). **Zelaya:** La Pimienta, *Pipoly 6291* (FR); along new road from Siuna to Matagalpa, ca. 31.4 km beyond Río Uli, near Wani, *Stevens 7493* (FR). ***Pfaffia completa*** (Uline & W. L. Bray) Borsch: NICARAGUA. **Rivas:** Isla de Ometepe, Volcán Madera, *Robleto 291* (FR, MO). PANAMA. **Darién:** Paca, *Williams 706* (US). ***Pfaffia costaricensis*** (Standley) Borsch: COSTA RICA. **Puntarenas:** Canton de Osa, Fila Costeña, Fila Cruces, cabezeras del Río Piedras Blancas, *Hammel 19289* (MO).

Acknowledgments. I thank the curators and directors of the herbaria MO, US, and WU for loaning specimens, of BM and K for loaning specimens and permitting the removal of pollen for SEM studies, and of M for allowing me to study the herbarium of C. F. P. v. Martius. I am grateful to Alan J. Paton for his kind help during my work on the collections at Kew, to Troels M. Pedersen, Mburucuya, Argentina, for hinting to me the true identity of *Hebanthe paniculata* Martius, and to Barry Hammel, Missouri Botanical Garden, for information on *Pfaffia costaricensis*. The SEM photographs were taken at the Forschungsinstitut Senckenberg using a CamScan CS 24 Compact scanning electron microscope. I am especially grateful to the research staff of the Missouri Botanical Garden, who first drew my attention to the Amaranthaceae.

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